ACCURATE AND FAST DETECTION OF TAG ANTENNA DAMAGE FOR RFID SENSING

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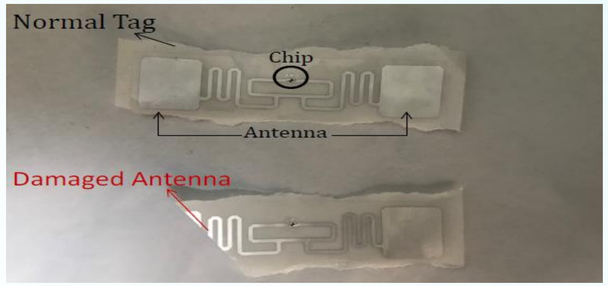
This project will be soon available at https://zhuyn-tsinghua.github.io/

Introduction

RFID tags may suffer from physical damage (e.g., deformation) caused by man-made and external factors in real-world applications



Main Problem

Severe impedance mismatch → Low sensing accuracy and reliability

Affected sensing applications:

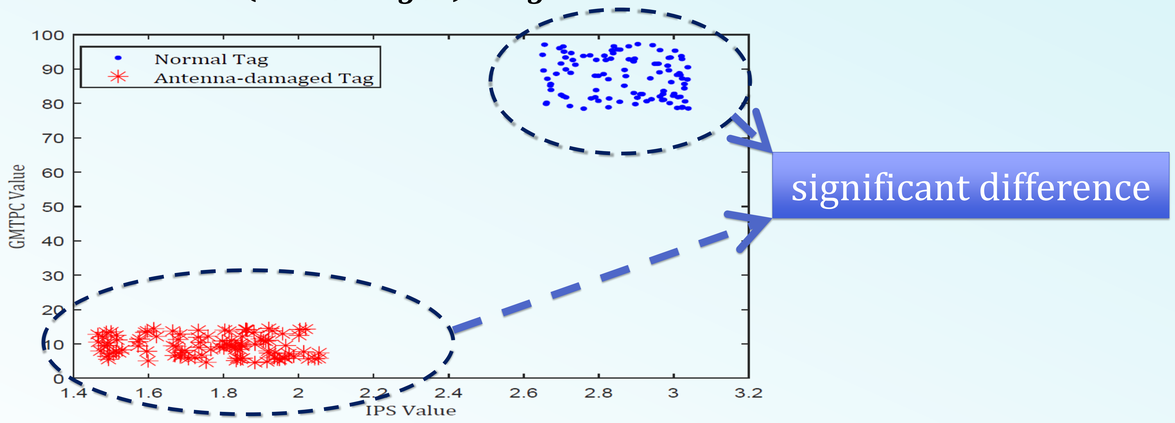
- Dual tags or tag array-based
- Impedance changes-related

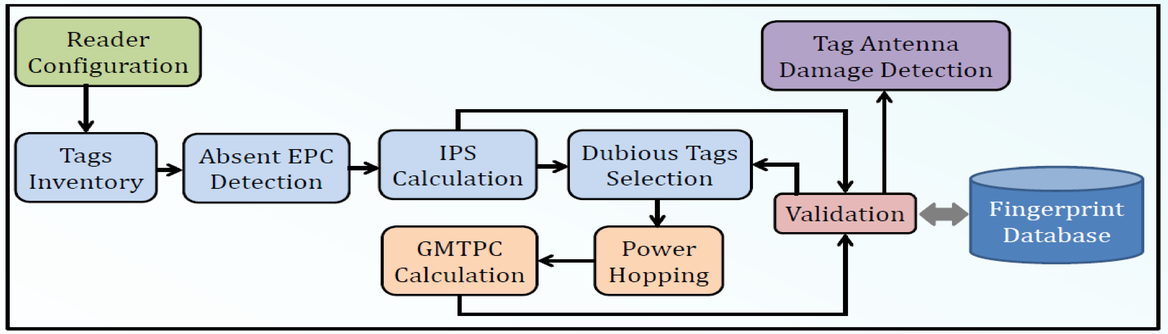
System Design

Two antenna damage-related fingerprints:

$$IPS = \{\theta - 4\pi d/\lambda + 2\pi\lfloor 2d/\lambda \rfloor\}^{+}, \{x\}^{+} = \begin{cases} x, x \geq 0 \\ x + 2\pi, x < 0 \end{cases}$$

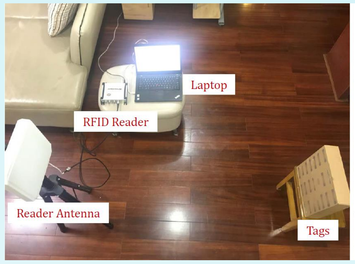
$$GMTPC = \delta\left(1 - |\Gamma_{tag}|^2\right) G_{tag} = d^2 / P_{threshold}$$

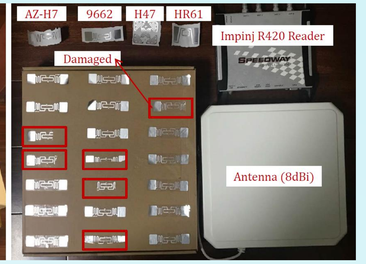




Evaluation

6 common forms of antenna damage
4 tag models and 84 examples in total





Results

Pros: Accurate ☑ Fast ☑ Universal ☑
Cons: Not Robust ☒

Tag Model	ADA	FAR	FRR	ATO	ATO (w/o SEL)
Alien 9962	98.6%	0.88%	3.74%	7.8s	17.9s
Impinj H47	92.8%	5.67%	7.85%	5.6s	12.4s
Impinj HR61	88.6%	11.75%	4.25%	9.6s	21.6s
NXP AZ-H7	97.4%	2.85%	3.20%	7.5s	16.8s

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